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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

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TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

SEAMLESS-HOSIERY KNITTER (hosiery) 684.885

S-130

TI 001 562

U. S. Employment Service in
Cooperation with
Tennessee State Employment Service

U. S. DEPARTMENT OF LABOR
Bureau of Employment Security
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STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR SEAMLESS-HOSIERY KNITTER (hosiery) 684.885-010

5-130

Summary

The General Aptitude Test Battery, B-1002A, was administered during the week of August 19, 1957 to 54 Komet Knitting Machine Operators employed by the Rockwood Plant of the Burlington Hosiery Company, Rockwood, Tennessee. The criterion consisted of supervisory ratings in rank order. On the basis of mean scores, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes P-Form Perception, F-Finger Dexterity, and M-Manual Dexterity were selected for inclusion in the test norms.

GATB Norms for Seamless-Hosiery Knitter 684.885 - 5-130

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Seamless Hosiery Knitter 684.885.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for 5-130

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
P	CB-1-A CB-1-L	75	P	Part 5 Part 7	75
F	CB-1-O CB-1-P	75	F	Part 11 Part 12	70
M	CB-1-M CB-1-N	75	M	Part 9 Part 10	75

Effectiveness of Norms

The data in Table IV indicate that 13 of the 20 poor workers, or 65 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 65 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 23 of the 30 workers who made qualifying test scores, or 77 percent, were good workers.

TECHNICAL REPORT

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Seamless-Hosiery Knitter (Hosiery) 684.885

II. Sample

The General Aptitude Test Battery, B-1002A, was administered during the week of August 19, 1957, to 58 Komet Knitting Machine Operators employed by the Rockwood Plant of the Burlington Hosiery Company, Rockwood, Tennessee. The tested sample included as many of the 87 experienced workers on this job who volunteered to be tested as the company could work into the testing schedule. Of the 58 workers tested, 2 workers over 50 years of age who scored consistently below average on all the aptitudes and high on job proficiency rating, one worker with a visual defect, and one worker for whom criterion data were not available, were eliminated from the sample. Thus, the final sample consisted of 54 workers (48 women and 6 men).

Supervisors estimated the training period for this job to be from six weeks to two months.

Applicants for the job must be at least 18 and preferably not over 35 years of age. Previous experience is not necessary but desirable. Applicants must be able to read, write, and count. Other than the use of the Ortho-Rater eye examination which fails about 4% of all applicants, the main selection device is the interview.

Table II shows the means, standard deviations, ranges, and Pearson product-moment correlations with the criterion for age, education, and experience.

TABLE II

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience

Seamless-Hosiery Knitter (Hosiery) 684.885
N = 54

	M	σ	Range	σ
Age (years)	30.2	6.8	19-44	.206
Education (years)	8.4	1.6	5-12	.150
Experience (months)	26.6	22.4	5-94	.226

There are no significant correlations with the criterion for age, education or experience. The data in Table II indicate that this sample is suitable for test development purposes with respect to age, education, and experience.

III. Job Description

Job Title: Seamless-Hosiery Knitter (hosiery) 684.382-010

Job Summary: Operates a battery of 13 to 18 machines that knit the leg, heel, foot and toe of a number of hose in a continuous piece of tubing which is later separated at the proper place to make individual seamless hose ready for the toe to be looped by the Looper: Pulls hose from machine and inspects yarns to detect low or empty cones. Separates hose on hand and places separated hose over dozen rack. Ties on and stacks yarn. Counts off 24 socks, ties string around the dozen pairs and puts hose in bag. Maintains clean machines. Records number of hours of work each day, and style and quantity of hose produced.

Work Performed: Checks orders, size and line at the beginning of each shift by inspecting the machine order and by inspecting the completed hose for line and size to determine the compliance with the machine order:

Pulls hose from machine. Pulls hose from can with left hand when tension take-up rod is on high cam and machine is reciprocating (in head and toe) making sure 5 or 6 high links have passed under drum pawl lug, since pulling hose from the can at another time might result in a serious hand injury. Grasps toe of hose with thumb and first two fingers of left hand with the turn rollers parallel with the operator. Points toe to the left. Inserts point of scissors, held in right hand, one inch from loose stitch near right hand gore between draw yarn and welt. Pulls out loose end of draw yarn. Grasps draw yarn that has been pulled out and inserts scissors in loose stitch where draw yarn came out and cuts about 4 stitches diagonally toward toe. Pulls draw yarn all the way out and turns toe over. Picks up large loose course next to welt with point of scissors and pulls yarn out. Flips loose end of sock back in can and places pull threads in can.

Inspects yarns every time hose is pulled from machine to detect low or empty cones.

Separates hose on hand. Grasps top of first sock on string of hose and pulls hose over left hand until thumb comes into toe, other fingers extending into top of next hose. Turns left palm toward operator and inserts point of scissors in loose stitches diagonally toward toe. Turns left hand over with thumb pointing down slightly and picks up stitch next to welt and pulls yarn out. Spreads left hand slightly so as to loosen remaining course. Inspects and turns hose as they are removed from hand and places separated hose on his shoulder. Pulls another sock over left hand, placing thumb and fingers as in first sock and repeats the above operation for pulling until all socks in string have been separated. Places separated hose over dozen rack.

Shuts machine off if not making good hose and places defective hose over tension take-up operating lever if minor defect and over the cable adjusting screws over the heel bolt rod if a major defect. Minor defects include the following: bad needles, bad sinker, broken slider, press off in heel or toe and press off in leg or foot. Major defects are smash ups, broken parts, machine hung up, etc.

Ties on and stacks yarn. Shuts off machine if not stopped and breaks yarn from almost empty cone. Takes off empty cone and sets new cone on peg. Takes loose end from new cone and loose end hanging from tension and ties together in overhand knot. Clips ends off about one-half inch to knot. Stacks yarn by setting on peg full cone under low cone and ties tail of low cone and main strand of full cone with overhand knot. Clips ends off about one-half inch to knot.

Gets yarn from bins at end of his set of machines and checks label on inside of cone for correct yard count and notifies supervisor if bins are empty or yarn count incorrect.

Counts off 24 socks and ties string in bow knot around the dozen (pair) and puts in bag.

Ties up bag with bow knot when order or lot is completed and makes out tickets putting down knitter number, number of dozen, and size in bag on knitter and master ticket and knitter number only on inspection ticket.

Places ticketed bag in designated place and replaces empty bag in bag holder and ties up and tickets waste.

Starts machine. Checks all yarns to see if they have dropped out of yarn trip stop tension and if so resets stop motion by pulling up on stop motion trip lever on left side of machine and pulling up on lever on the side of the stop motion unit. Places yarn in trip stop tension before resetting stop motion by: grasping yarn over cross rod with left hand; taking yarn fork in right hand; placing yarn across prongs in yarn fork; grasping yarn under tension with left hand; raising prongs of yarn fork over trip in the yarn trip stop tension; pulling yarn down slightly with left hand until yarn slides into the porcelains; releasing yarn from yarn fork and replacing hand yarn fork on yarn rack. Checks lint in tensions and fingers. Checks yarns on both feeds before starting machine. Looks for bad needles and load ups. Turns machine slowly and turns machine on and if it kicks off, flags machine. Watches red and white weight to see that all machines are running.

Threads single feed body yarn through proper channels when a thread breaks. Flags machine if in need of double feed threading.

Maintains clean machines by cleaning grease, lint, oil, etc., from improper areas on the machine.

Records number of hours of work each day, style and dozen produced.

IV. Experimental Battery

All the tests of the GATB, B-1002A, were administered to the sample group.

V. Criterion

The criterion consisted of rank order ratings, converted to linear scores. The rank order ratings were prepared by each foreman and the head fixer for each shift. The shift foreman has line supervision over all workers in the knitting room; the head fixer has line supervision over the fixers and functional supervision over the knitters and is subordinate to the shift foreman. In the absence of the shift foreman, the head fixer is sometimes delegated the foreman's duties.

The rank order ratings made by each shift foreman were converted to linear scores and combined into one distribution for a total sample of 54 workers. The rank order ratings made by each head fixer were converted to linear scores and combined into one distribution for a total sample of 49 workers. (one head fixer could not rate five of the workers on his shift because he did not know them well enough.) A Pearson product-moment correlation of .61 was obtained between the two distributions of linear scores on the 49 workers with two ratings. Application of the Spearman-Brown Prophecy formula raised that correlation coefficient to .76 for the average of the two sets of ratings. Considering this degree of agreement between the two distributions, a final distribution on the sample of 54 workers was formed by computing average linear scores for each of the 49 workers rated by a shift foreman and a head fixer and using the one rating of the other five workers rated only by the shift foreman.

VI. Statistical and Qualitative Analysis

A. Statistical Analysis:

Table III shows the means, standard deviations, and Pearson product-moment correlations with the criterion for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general working population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

Seamless-Hosiery Knitter (hosiery) 684.885
N = 54

Aptitudes	M	σ	r
G-Intelligence	77.8	11.4	.299*
V-Verbal Aptitude	81.0	11.9	.143
N-Numerical Aptitude	75.3	14.7	.319*
S-Spatial Aptitude	79.9	14.1	.115
P-Form Perception	80.9	14.7	.114
Q-Clerical Perception	86.0	10.0	.057
K-Motor Coordination	90.0	15.3	.063
F-Finger Dexterity	93.9	18.9	.128
M-Manual Dexterity	80.1	15.8	.114

* Significant at the .05 level

The highest mean scores in descending order of magnitude were obtained for Aptitudes F, K, and Q. All the aptitudes have standard deviations of less than 20.

For a sample of 54 cases, correlations of .348 and .268 are significant at the .01 level and the .05 level of confidence, respectively. Aptitudes G and N correlate significantly with the criterion at the .05 level.

B. Qualitative Analysis:

The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation:

Form Perception (P) - required to inspect yarn to detect low or empty cones and to inspect the completed hose for line and size to determine the compliance with the machine orders.

Motor Coordination (K), Finger Dexterity (F), and Manual Dexterity (M) - required to grasp and pull hose over hands during operation, to separate hose, stack yarns, thread yarn through proper channels when thread breaks, and to tie up bags of socks when lot is completed. Also required to clean grease, lint, oil, etc., from improper areas on the machine.

C. Selection of Test Norms:

Aptitudes P, K, F, and M were considered further for inclusion in the test norms on the basis of the quantitative and qualitative factors cited above. All these aptitudes appeared to be important on the basis of job analysis data, and Aptitudes K and F showed the highest mean scores for the sample. Although Aptitudes G and N had correlations with the criterion significant at the .05 level and Aptitude Q had a relatively high mean score, these aptitudes were not given further consideration for inclusion in the test norms because there was no other qualitative or quantitative evidence of significance.

Various combinations of Aptitudes P, K, F, and M with appropriate cutting scores were selected as trial norms. The relationship between each of these sets of trial norms and the dichotomized criterion was determined by means of the tetrachoric correlation technique. A comparison of the results showed that norms consisting of P-75, F-70, and M-75 had the best selective efficiency for this sample.

In test development studies, an attempt is made to develop a set of norms such that the cutting score for each aptitude will be set at a five-point score level close to one standard deviation below the aptitude mean of the experimental sample. Adjustments of cutting scores from one standard deviation below the mean are made to effect better selective efficiency of the norms. In the case of this study, the aptitude cutting scores are each within ten points of one standard deviation below the aptitude mean of the experimental sample.

VII. Concurrent Validity of Norms

For the purpose of computing the tetrachoric correlation coefficient between the test norms consisting of P-75, F-70, and M-75 and the criterion and applying the Chi Square test, the criterion was dichotomized by placing as close as possible to one-third of the sample in the low criterion group. This was accomplished by setting a criterion critical score of 43. Those workers who received a linear score of 43 or more were placed in the high criterion group; all others were placed in the low criterion group. This resulted in 20 of the 54 workers, or 37 percent of the sample, being placed in the low criterion group.

Table IV shows the relationship between test norms consisting of Aptitudes P, F, and M with critical scores of 75, 70, and 75, respectively, and the dichotomized criterion for Seamless-Hosiery Knitter 684.885. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Relationship between Test Norms Consisting of Aptitudes P, F, and M with Critical Scores of 75, 70, and 75, Respectively, and the Criterion for Seamless-Hosiery Knitter (hosiery) 684.885

N = 54

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	11	23	34
Poor Workers	13	7	20
Total	24	30	54

$r_{tet} = .49$ $\quad X^2 = 4.194$

$\sigma_{r_{tet}} = .22$ $\quad P/2 < .025$

The data in the above table indicate a significant relationship between the test norms and the criterion for this sample.

VIII. Conclusions

On the basis of mean scores, correlations with the criterion, job analysis data and their combined selective efficiency, Aptitudes P, F, and M with minimum scores of 75, 70, and 75, respectively, are recommended as B-1002 norms for the occupation of Seamless-Hosiery Knitter 684.885. The equivalent B-1001 norms consist of P-75, F-75, and M-75.

IX. Determination of Occupational Aptitude Pattern

When the specific test norms for an occupation include three aptitudes, only those occupational aptitude patterns which include the same three aptitudes with cutting scores that are within 10 points of the cutting scores established for the specific norms are considered for that occupation. The only one of the existing 23 occupational aptitude patterns which meets these criteria for this study is OAP-16, which consists of P-75, F-80, and M-80, for B-1002. The selective efficiency of OAP-16 for this sample was determined by means of the tetrachoric correlation technique. No significant relationship was obtained between OAP-16 and the criterion for this experimental sample. Therefore, none of the existing 23 occupational aptitude patterns is recommended for Seamless-Hosiery Knitter 684.885. However, the data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.